PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : G06F 17/30 — A1

(11) International Publication Number: WO 00/52604

(43) International Publication Date: 8 September 2000 (08.09.00)

(21) International Application Number: PCT/US00/05790

(22) International Filing Date: 6 March 2000 (06.03.00)

(30) Priority Data:

60/122,932	5 March 1999 (05.03.99)	US
Not furnished	3 March 2000 (03.03.00)	US

(71) Applicant: STAYHEALTY. COM [US/US]; 690 1/2 E. Bridge Street, Elkader, IA 52043 (US).

(72) Inventors: COLLINS, John, R.; 225 Elcilo Lane, Bradbury, CA 91010 (US). GREEN, Ronald, L.; 906 North Main Street, Elkader, IA 52043 (US). DAVIS, Leslie, G.; 301 Chestnut Street, Elkader, IA 52043 (US). KAVARS, Christopher, L.; 160 Sandy Lane, Clermont, IA 52135 (US). CARNES, Bradley, J.; 125 1/2 South Main Street, Elkader, IA 52043 (US). PETERSEN, Brian, W.; 2822 North Frederick Avenue, Milwaukee, WI 53211 (US). SCHLAGER, Kenneth, J.; 12825 Elmwood Road, Elm Grove, WI 53122 (US).

(74) Agents: MORRIS, Francis, E. et al.; Pennie & Edmonds LLP, 1155 Avenue of the Americas, New York, NY 10036 (US).

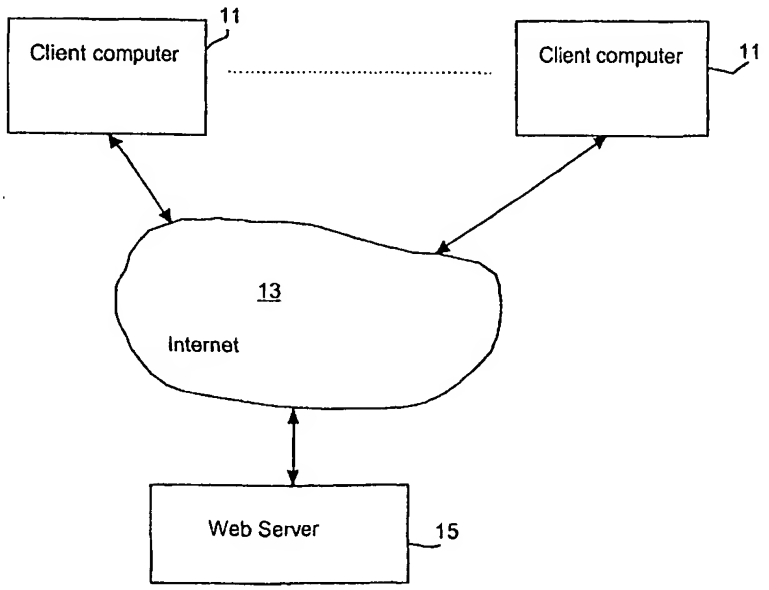
(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published

With international search report.

Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: SYSTEM AND METHOD FOR ON-LINE HEALTH MONITORING AND EDUCATION



(57) Abstract

A method of delivering health related information to a user (13). The method includes the steps of receiving a first set of data from the user (11), identifying first health related information based on the first set of data and forwarding (15) the first health related information to the user. The method further includes the steps of receiving a second set of data from the user (11) after the first health related information has been forwarded to the user and determining whether progress has been made to achieve a goal based on the second set of a data. A corresponding software application and a system (13) are also discussed.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	**ES**	Spain	**LS**	Lesotho	**SI**	Slovenia
AM	Armenia	**FI**	Finland	**LT**	Lithuania	**SK**	Slovakia
AT	Austria	**FR**	France	**LU**	Luxembourg	**SN**	Senegal
AU	Australia	**GA**	Gabon	**LV**	Latvia	**SZ**	Swaziland
AZ	Azerbaijan	**GB**	United Kingdom	**MC**	Monaco	**TD**	Chad
BA	Bosnia and Herzegovina	**GE**	Georgia	**MD**	Republic of Moldova	**TG**	Togo
BB	Barbados	**GH**	Ghana	**MG**	Madagascar	**TJ**	Tajikistan
BE	Belgium	**GN**	Guinea	**MK**	The former Yugoslav Republic of Macedonia	**TM**	Turkmenistan
BF	Burkina Faso	**GR**	Greece			**TR**	Turkey
BG	Bulgaria	**HU**	Hungary	**ML**	Mali	**TT**	Trinidad and Tobago
BJ	Benin	**IE**	Ireland	**MN**	Mongolia	**UA**	Ukraine
BR	Brazil	**IL**	Israel	**MR**	Mauritania	**UG**	Uganda
BY	Belarus	**IS**	Iceland	**MW**	Malawi	**US**	United States of America
CA	Canada	**IT**	Italy	**MX**	Mexico	**UZ**	Uzbekistan
CF	Central African Republic	**JP**	Japan	**NE**	Niger	**VN**	Viet Nam
CG	Congo	**KE**	Kenya	**NL**	Netherlands	**YU**	Yugoslavia
CH	Switzerland	**KG**	Kyrgyzstan	**NO**	Norway	**ZW**	Zimbabwe
CI	Côte d'Ivoire	**KP**	Democratic People's Republic of Korea	**NZ**	New Zealand		
CM	Cameroon			**PL**	Poland		
CN	China	**KR**	Republic of Korea	**PT**	Portugal		
CU	Cuba	**KZ**	Kazakstan	**RO**	Romania		
CZ	Czech Republic	**LC**	Saint Lucia	**RU**	Russian Federation		
DE	Germany	**LI**	Liechtenstein	**SD**	Sudan		
DK	Denmark	**LK**	Sri Lanka	**SE**	Sweden		
EE	Estonia	**LR**	Liberia	**SG**	Singapore		

SYSTEM AND METHOD FOR ON-LINE HEALTH MONITORING AND EDUCATION

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application No. 60/122,932 filed March 5, 1999, which is incorporated herein by reference in its entirety.

FIELD OF THE INVENTION

The present invention is directed to an Internet based health education system. In particular, the present invention provides individualized health and fitness education regimens/programs based on physiological measures, demographic information and/or psychological information of its users.

BACKGROUND OF THE INVENTION

Health education has been proven to be an effective means for both preventing and managing diseases such as hypertension, congestive heart failure, diabetes and the like. For instance, educating individuals on health related topics such as diet, exercise, pharmaceutical regimens and self-examination have been proven to reduce health care costs through disease prevention and early detection. In particular, a behavioral modification technique is a mechanism in which health education acts to prevent the emergence or advancement of illness. Behavior modification is not new. Behavior modification was prevalent in the days of medicine when physicians made house calls. For example, physicians used methods such as authoritative pressure, peer pressure and family intervention to help motivate patients to conform to care regimens and preventing self-destructive behavior. As medicine advanced, physicians became more specialized and personal interaction between patients and physicians have been minimized. Costly high tech instruments and procedures replaced laborious physician-patient intervention.

To compound this problem, medical care costs have increased at an accelerated rate over the recent decades. The medical community has responded with cost containment measures. Such measures include earlier hospital discharges, total quality management methods to streamline medical procedures, and standard care protocols or guidelines for caring for specific disease exacerbations. Still, the costs of care for various

disease populations prove to be difficult to manage and result in highly unpredictable cost structures. In turn, this caused even less interaction between physicians and patients, thereby reducing the time required to utilize the behavior modification techniques. Ultimately, the behavior modification techniques inherent to the patient-physician relationship were lost.

Furthermore, in order to streamline and reduce expenditure, computerized medical expert systems have been developed to assist medical staff in making decisions. These systems benefit the patient by inclining the caregiver to make better health care decisions for their patients. However, these computerized systems usually target more acutely ill patients. The high cost of implementing the care advocated by the computerized systems financially restricts its usage. Preventive health expert systems targeting fitness and wellness issues are not financially justified since the deployment and implementation costs greatly outweigh the preventive dollars saved.

In addition, biosensors (*i.e.*, sensors measuring various vital signs of patients) have usually been expensive and/or inaccurate devices. They also do not have the ability to communicate data produced by them or to store/monitor the produced data over a sustained period of time. A lack of integration of different biosensors also means that there has been no easy way to build up a complete picture of an individual's health status.

In another aspect of the current developments, a wealth of health related information sources provided by the Internet holds a potential of providing comprehensive health education to individuals. However, the information sources are difficult to access to a layperson. For instance, a layperson must possess not only computer skills in using the Internet but also extensive knowledge of the health sciences to locate health information that is applicable and understandable. As discussed above, a number of disparate technological developments have been made in order to computerize/automate health care delivery. However, there has not been much effort spent in integrating the various technologies to usher in a comprehensive health education system.

SUMMARY OF THE INVENTION

The present invention provides cost effective health educational systems that promote health, wellness and fitness of its users.

In one aspect, the present invention preferably provides a number of sensors that collect a variety of the body's vital signs, transmit the collected data to a client computer. The client computer, via the Internet transmits the received data to a Web server facility for further processing. At the Web server, health education material generated (*i.e.*, located and/or created) based on the received data is downloaded to the client computer to be accessed and displayed by its users.

The data from the sensors helps construct an overall picture of the individual user's health index. Therefore, the present invention may provide: early detection of health problems; continuous and inexpensive monitoring critical and non-critical physiological information; alert systems to notify of changes in health status; increased awareness and encouragement to improve health and ultimately, a decrease in the incidence of preventable illnesses or health problems such as obesity, drug abuse, diabetes, etc., thereby improving its users' health.

In particular, the present invention provides a health education system that continuously modifies its users' health related behavior through distribution of health and wellness educational material that is preferably customized to the individual users based on the users' behavioral models, cognitive processing tendencies, physiological measures, questionnaire results, and patient health goals and interests. The present invention also continually updates health education material delivered to the users by measuring the effectiveness of behavioral modification at both individual users and all user levels.

In other words, the present invention determines its success in optimizing the users educational regimen based on users' physiological and behavioral base measures. An educational regimen includes what type of educational material is to be provided as well as when they are to be provided to the user. The present invention's remote biosensors are preferably used to measure the physiological condition of the users. Users' health questionnaires are preferably used to measure subjective health conditions. In another embodiment, the time spent by the user on specific topical material is also utilized in measuring user's interests. Both measures are utilized to establish a comprehensive picture

of the users' general health status. Objective physiological measures enable users and health professionals to assess health states with respect to established baseline measures.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred features of the present invention are disclosed in the accompanying drawings, wherein similar reference characters denote similar elements throughout the several views, and wherein:

FIG. 1 is a block diagram of various components of the present invention;

FIG. 2 is a block diagram of various components connected to a client computer of the present invention;

FIG. 2 is a block diagram of various components of a server computer of the present invention;

FIG. 4 is a flow chart for a software application configured to perform vector matching in the present invention;

FIG. 5 is a graph representing examples of various profiles of the present invention;

FIG. 6 is a flow chart for a software application configured perform profile matching after an eigenvector analysis; and

FIG. 7 is a flow chart for a feedback software application configured to provide health education material to the client computer.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 1, the present invention preferably includes a number of client computers 11 connected to a web server 15, configured to deliver health education materials to client computer 15, via the Internet 13. In an alternative embodiment, client computers 11 are connected to web server 15 via local area network (LAN) or wide area network (WAN) which may also be connected to the Internet 13. Various other ways to connect client computers 11 to web server 15 are also available in the art. The following discussion is mostly directed to one client computer 11 and one user thereof. It should be noted that same descriptions of the client computer and its features are to be duplicated in other client computers 11 and to numerous users thereof.

Client computer 11 is preferably a personal computer (PC). In alternative embodiments, client computer 11 is a Unix workstation. In yet another embodiment, client computer 11 is not required to include a microprocessor, as long as client computer 11 is capable of sending and receiving Web browser messages over the Internet with Web server 15. The specific type of processor and operating system used by client computer 11 is not important to the present invention. Client computer 11 may be operated using Windows®, Linux, Unix, a Web based operating system or other operating systems available in the art.

As noted above, client computer 11 is preferably linked to Web server 15 via the Internet. More specifically, client computer 11 and Web server 15 are connected through an Internet Service Providers (ISP). Client computer 11 and Web server 15 preferably communicate with each other using a common communication protocol, such as Hypertext Markup Language (HTML), Java, JavaScript, Extended Markup Language (XML) or other similar communication protocol available in the art.

Client computer 11 is preferably operated by one or more users privately in their respective homes. In an alternative embodiment, public client computers are available in locations such as health clubs and other health care providers.

Turning to FIG. 2, client computer 11 preferably includes peripheral devices such as speakers 21, a display monitor 23, an input data interface 25 and an input device 27. Speakers 21 are configured to play audio files, and monitor 23 is configured to display graphics and Web pages and play video files. Input data interface 25 is configured to be coupled to a number of sensors 29a-h, which are discussed below, and configured to receive data from sensors 29a-h and forward them to client computer 11. Input device 27 is at least one of a keyboard, a microphone and a scanner.

The sensors coupled to input data interface 25 include an activity monitor 29a, a pulse monitor 29b and a bio-impedance measuring device 29c, which are discussed in detail later. The sensors may also include a calorie tracker 29d, a weight scale 29e, a blood pressure sensor 29f, an electronic stethoscope 29g, an asthma monitor 29h and other devices that sense various vital signs of the human body available in the art.

For discussion purposes only, the above discussed sensors 29a-h are divided into two categories: data logging devices, which collect and output data with a time reference, and flash type devices, which collect and output data from a single session or event.

An example of the data logging devices is activity monitor 29a, which is preferably designed to be a wearable device having the size and weight of a pager. In addition, activity monitor 29a includes accelerometers configured to measure movement of its user, a processor configured to execute necessary computer programs, a data logging device configured store data generated by the accerlometers and a timing device configured to reference the stored data with time. Activity monitor 29a may also include a power source (*e.g.*, batteries), a status indicator notifying the user of such things as low power status and collection activity in progress, and a digital display to show the stored data. Activity monitor 29a provides the user a means for evaluating and benchmarking his/her personal activity.

Pulse monitor 29b is also a data-logging device that tracks its user's pulse rate and provides a reference time line. Pulse monitor 29b is preferably a stand alone device attached to a specified location on or near the body of a user. Pulse monitor 29b preferably includes an audible feature to alert the user when his/her heart rate has achieved a certain level or a specific range. In an alternate embodiment activity monitor 29a is housed together with pulse monitor 29b and, optionally, a blood oxygen monitor.

Bio-impedance measuring device 29c, which is an exemplary flash type device, preferably records data on demand, using the hands of a user as a data collection point. Bio-impedance measuring device 29c is constructed from plastic and stainless steel and has a spherical profile. In operations, a user places his/her hands on palm and finger indents of bio-impedance measuring device 29c, allowing it to record physiological data such as body composition (*e.g.*, muscle, fat and water).

Each sensor 29a-h preferably includes a communication device configured to transmit the stored data to input data interface 25 and receive instructions therefrom as well. It should be noted that communication between sensors 29a-h and input data interface 25 is achieved as known in the art (*e.g.*, wire or wireless link, or one-way or two-way). Once data are forwarded to input data interface 25, they are then relays to client computer 11.

Input data interface 25 is preferably a stand alone device configured to provide an interface between client computer 11 and sensors 29a-h. In an alternative embodiment, each sensor is provided with an input data interface specifically designed therefor. In yet another embodiment, input data interface is provided as part of client computer 11.

The data collected from sensors 29a-h may be stored and retrieved by client computer 11. Preferably the collected data are forwarded to Web server 15 by client computer 11. In an alternative embodiment, the collected data is electronically transmitted or accessed by third party users nominated by the user, such as physicians, personal fitness trainers and insurance providers. Moreover, client computer 11 is also configured to providing monitoring function which includes an "alert" capability. An alert signal is generated if the collected data falls outside or within predetermined ranges depending on the nature of the collected data. The alert signal may be immediately sent to third party nominees such as medical staff. As discussed above, each sensor 29a-h is preferably configured to collect the health related data and communicate the collected data to input data interface 25. The collected data are eventually relayed to Web server 15 for further processing as discussed below. This allows sensors 29a-h to be implemented with minimum hardware and software because no hardware is required for the data translation or the data presentation.

The data processing, translation and/or presentation are all preferably performed by client computer 11 and/or Web server15. For instance, a Web page may be downloaded from Web server 15 to client computer 11. The Web page may contain software applications to receive data collected by input data interface 25, process the collected data and present the processed data on display monitor 23 using a graphical user interface (GUI). For instance, the user can review the calorie expenditure over the entire time-span in the form of a graph. In one embodiment, the collected data is saved only for one session. In another embodiment, an export capability is provided for the energy/time graph to be exported to a spreadsheet program and may also allow the user to compare his/her data with national averages.

In yet another embodiment, each sensor 29a-h is configued to display the collected data. For instance, activity monitor 29a may be further configured to display calories or other relevant energy values.

In addition to sensors 29a-h reporting their respective data to client computer 11 and/or Web server 15 for storage and processing, sensors 29a-h may also receive instructional data directly from Web server 15. These instructional data may be used to upgrade functionality, correct operational discrepancies or enable and disable one or more

sensors 29a-h remotely. This feature thus provides low cost firmware upgrade, and overall system enhancement.

Referring back to FIG. 2, input device 27, in combination with monitor 23 and speakers 21, allows client computer 11 to collect other health related information about its user.

In particular, when a user first logs into Web server 15, the user is asked to answer a number of questionnaires. More specifically, one or more Web pages are downloaded from Web server 15 to client computer 11 and displayed on monitor 23. The Web pages ask the user to enter demographic information, physical health status information and other health related information. In response, the user enters responses using input device 27. Subsequently, the entered responses are collected and forwarded to Web server 15.

In particular, a first Web page is configured to inquire about the level of interest toward each disease. An example of codified user's response is shown in Table 1 below.

Disease States	Interest Level
Hypertension	1
Depression	3
Diabetes	4
Dementia	3
Glaucoma	1
...	

Table 1

The user's level of interest on a particular disease topic may vary depending on whether he/she or loved ones are diagnosed, his/her level of concern with the disease, or whether he/she is on the receiving or giving end of managing the disease. An example of codified user's response is shown below in Table 2.

Level of Interest	Normalized Value
Little Interest	1
Preventive measures	2
Screening methods	3
General management means	4
Aggressive management means	5
Offering support to those coping	6

Table 2

A second Web page is a questionnaire that asks the user's preferences in exercise and athletic activities. An example of user response is shown below in Table 3.

Exercise	Interest level
Aerobics	5
Bicycling	7
Body building	2
Baseball	5
Bowling	6
Crochet	1
Golf	6
Karate	4
Racquetball	1
Running	8
Soccer	5
Swimming	6
Tennis	3

Table 3

The user's level of interest in athletic activities may vary depending on how he/she participates in the activity. An example codified user response is shown below in Table 4.

Interest	Numeric Representation
Little interest	1
Read about	2
Watch others play	3
Would like to learn more about	4
Consider playing	5
Play occasionally	6
Play regularly	7

Table 4

A third Web page is configured to ask general health Interests of the user. An example of a codified user response is shown below in Table 5.

General Health Interest	Interest Level
Healthier eating	6
Meditation	8
Yoga	1
Relaxation and stress reduction	2

Herbal remedies	5
Positive thinking	2
New health procedures	7
New pharmaceuticals	8
Smoking cessation	9
Alcohol cessation	1
Narcotic cessation	1

Table 5

A fourth Web page is configured to questions relating to social and learning tendencies. Psychology and social science have shown that within the wide spectrum of social profiles certain cognitive tendencies emerge that are indicative of how an individual processes information. Since human information processing is so closely correlated with social interaction, often, how an individual learns is linked with our social tendencies.

The Meyers Briggs test is one well-known and accepted means of measuring these social/learning tendencies. It has been used by social scientists for many years and of late is being adopted by business as a human resource tool to improve or better predict employee "team" social dynamics. The Meyer-Briggs test advocates that four social dimensions exist in which individuals have clear natural preferences and that each one of these are polar opposites. The user's response to a series of questions identifies his/her predisposition to these dimensions. The indicator is a measure of preferences only, not the actual skill. The four social dimensions, poles and example tendencies of a user are listed in Table 6.

Social Profile (Dimension)	Pole	Tendency
Relate to others and collect information	Extroversion	3
	Introversion	7
Filtering information	Sensing	6
	Intuition	5
Decision making	Thinking	8
	Feeling	2
Actions	Judging	9
	Perceiving	1

Table 6

Extrovert individuals are often motivated by external stimulus such as interacting with other individuals. They tend to communicate more when solving problems.

Introvert individuals tend to be motivated by internal reflection and often perform more internal processing prior to communicating when solving problems. Individuals with sensing tendencies gather information that is factual, tangible, actual and real. Common sense and logic are used to make decisions. Individuals with intuition tendencies consider the more subjective information to form a more macroscopic model of the information. Individuals with thinking tendencies make decisions based on logic. Individuals with feeling tendencies make decisions based on values. Individuals with Judging tendencies prefer more regimented plans. They enjoy making plans and carrying them out as planned. Individuals with perceiving tendencies are more curious, flexible and adaptable to change and often result in using less convention in carrying out activities. Individuals have a degree of tendency in both poles of each dimension. In some individuals one pole dominates and in others their tendency is split down the middle.

A fifth Web page is a questionnaire configured to ask behavioral tendencies of the user. A user's behavior tendencies indicate learned habitual response tendencies toward various forms of stimuli. The response is a product of physical development, cultural values, family values, and personal experiences among a myriad of other confounding variables that influence the way the subconscious and consciousness negotiate and rationalize our actions. Social science has shown that these behaviors can be altered through various types of conditioning. Psychology has standardized questionnaires that are used to profile these social tendencies. An example of codified user's response is shown in Table 7.

Behavioral Profile	Normalized Measure
Assertive	5
Timid	2
Independent	2
Dependant	4
Proactive	9
Reactive	5
Receptive to change	1
Resistant to change	9
Destructive	8
Constructive	2

Table 7

User responses to the above discussed Web-pages are collected and forwarded to Web server 15. Moreover, in addition to above discussed questionnaires, the

user's existing electronic health and billing records may also be collected and retrieved, with the user's permission. More specifically, the health care industry has codified diagnosis and care action by CPT and ICD9 codes that identify when patients received certain procedures and were diagnosed with specific health conditions. Also, many patients' health records are now in electronic form. The user is encouraged to release his/her electronic medical records to quickly build the user's health history. Diagnosis, medications, family health predispositions are some of the information fields that can be easily retrieved.

Even though the above discussed questionnaires are presented to the user by various Web pages, it should be noted that the questionnaires may be sent to the user via mail in paper form to be answered returned and to be entered to Web server 15. Further, in the Briggs-Meyer example, the test may be administered by a licensed proctor. It should also be noted that the above questions and their corresponding entries are provided therein only as examples. There are myriads of questions and entries that can be used by one of ordinary skill in the art, which are all contemplated within this invention.

The above discussed data collected by sensors 29a-h and coded responses of the user to the numerous questionnaires are collected by client computer 11. It should be noted that the user is not required to respond to the questionnaires each time he/she browses Web server 15. The user is preferably required to respond to the questionnaires initially.

Web server 15 that includes one computer is illustrated in FIG. 3. However, Web server 15 of the present invention preferably includes one or more Unix workstations, PC's, a number of computers connected together for parallel processing or a supercomputer. In other embodiments, Web server 15 may also include computers having similar processing power capacity to client computer 11.

Referring to FIG. 3, Web server 15 includes a communication interface 31, one or more processors 33 (*e.g.*, one or more microprocessors), random access memory (RAM) 35, read only memory (ROM) 37, a database interface 39 and other conventional components of an Internet Web server as known in the art.

Communication interface 31 is preferably configured to transmit and receive electronic messages from remote locations (*i.e.*, client computers 11) via the Internet 13 using a common communication protocol such as TCP/IP and/or a common Web browser.

In particular, communication interface 31 receives the above discussed data/information collected by client computers 11.

ROM 35 preferably stores a number of software applications which are to be downloaded to processor 33 and executed therein. The software applications include operating systems, device drivers and other software applications as known in the art. Moreover, the software applications further include computer executable instructions necessary to run various matching methods, Web page generation and storage and other software applications necessary to provide numerous features of the present invention as discussed herein. For instance, one software application generates a user profile based on received data/information collected by communication interface 31. Each type of data points are called attributes. Exemplary attributes include data collected by individual sensors 29a-h, responses to the questions, how much time the user spends on particular subject matter and/or the purchasing habits of the user. A profile is preferably a collection of data points for each attribute.

Via database interface 39, Web server 15 is coupled to at least two databases: a heath education material database 39a and a user profile database 39b. Databases 39a,b are preferably implemented using conventional database management systems such as ORACLE®, SYBASE® or other similar products. Database interface 39 is configured to generate appropriate search commands to retrieve relevant data from databases 39a,b based on commands from processor 33. In an alternative embodiment, processor 33 may interface directly with databases 39a,b.

User profile database 39b is populated with the above discussed user profiles. More specifically, user profile database 39b stores user identification for each registered user. As profiles of various users are generated, they are stored into user profile database 39b. Each profile is saved as an entry into user profile database 39b. Further, user profile database 39b stores a history of each individual user's profiles. Each user profile database entry may include the following attributes for each user:

Objective Physiological measures: Weight, Body mass index, Blood pressure, Resting heart rate, participating Activities;

Subjective physiological measures: Quality of life indicia, Strength, Agility, Sleep value; and

Psychological objectives: Depression, Bi-polar, Positive attitude, Self Confidence, Feeling of self actualization, Self esteem.

The above-identified attributes may not exactly correspond to the data collected by sensors 29a-h and the questions in the questionnaires because the "raw" data received from client computers 11 are processed for effective presentation and processing. In one embodiment, the raw data collected by and received from client computers are normalized to monitor and report inter-user statistics on the collected data.

Health education database 39a is preferably populated with data relating to health education materials. The health education materials are preferably written materials, video clips, audio files or any other materials that are related to health education and capable being transmitted over the Internet to client computer 11. These materials are preferably found by searching third party Web pages over the Internet. Moreover, the materials may also be produced specifically for health education database 39a or scanned in from magazines and other written material.

When the health education materials are found and entered to health education material database 39a, they become entries in database 39a. In order to become an entry, the educational material is characterized with attributes similar to the user profile attributes as discussed above. In other words, each entry in database 39a has a profile. For instance, the attributes for health related education materials may include:

General subject – exercise, disease, nutritional.

Specific subject – running, aerobics, obesity, hypertension, Indian food.

Grade level readability

Technical or casual readability

Scientific or testimonial

Suggestive/authoritative

Required time to read.

Graphical/textual in nature

Positively reinforcing

Negatively reinforcing

The profiles containing the above discussed attributes are preferably generated by a software application. For instance, the software application reads and interprets the health education material by performing one or a combination of:

Key word search analysis,

Word count, length analysis,

Total words and total lines of text; and

readability analysis as known in the art.

In an alternative embodiment, the profiles for the education materials are generated by experts by reading and interpreting them. The above discussed methods of populating health education material database 39a are preferably performed off-line. It should be noted that the entries to database 39a preferably include Internet link addresses the actual materials and the above discussed profiles thereof. In an alternative embodiment, actual copies of the materials are stored in database 39a.

Once again the above discussed attributes for profiles of educational materials may not exactly correspond to the attributes for the user profile. However, these differences are accounted for in later processing steps described below.

Subsequently, a user profile received from client computer 11 is preferably matched against the entries in the health education material databases 39a. Table 10 illustrates a result of a software application that implements a simple matching between a user profile and a profile of one entry in health education material database 39a comparing only exercise attributes.

Attributes			
Exercise Attributes			
Active Exercise	**User profile**	**Profile of an entry in database 39a**	**Difference**
Aerobics	2	3	1
Weight lifting	1	7	6
Biking	8	6	2
Swimming	7	4	3

Team Exercise			
Basketball	2	8	6
Football	5	9	4
Baseball	3	9	6
Tennis	3	5	2
Leisure Exercise			
Walking	7	4	3
crochet	4	4	0
bowling	4	6	2
bachi ball	7	3	4
fishing	8	5	3
Outdoor Exercise			
canoeing	9	3	6
Hiking	9	3	6
Rock climbing	8	1	7
mountain biking	8	6	2
Insightful Exercise			
golf	5	9	4
rock climbing	8	1	7
tai chi	6	1	5
yoga	8	1	7

Table 10

Once an entry that matches the user profile in database 39a is located, the matching entry is transmitted to client computer 11 to be displayed or played by client computer 11. The benefits of the present invention become apparent at this point. In particular, the present invention provides health educational materials that are customized to the user's interests, health predisposition, physiological condition, education level, behavioral habits, cultural heritage and general demographics information. This ensures that health educational materials are applicable to the user's health state, appeal to the interests of the user, are non-offensive, and are highly readable and ultimately enjoyable and entertaining to the user.

For instance, as discussed above, the Meyers-Briggs test is one means of codifying the user's social and cognitive learning tendencies. These tendencies are utilized in the above discussed matching step to identify what health education materials will have more impact on the user. For example, a smoker with introverted, sensing, thinking and judging tendencies may be more affected by a document outlining morbidity and mortality statistics of smokers than a case study of how a typical user felt great about "kicking the

habit". In another example, for those who enjoy competition, the educational materials may be incorporated into various intellectual gaming formats. For instance, user-centric health topics could be incorporated into health-related crossword puzzles or trivia games that would be both educational and entertaining to the user. The games are to be played solitarily or against other users with similar interests anywhere in the world over the Internet. Just the act of using the present invention to achieve specific health goals is entertaining and may be a form of competition. Users can be pitted against other clients with similar health goals. For example, two users both desiring to increase lean muscle mass could compete against each other in attaining these goals within a specified time frame. Since both users use the same objective measuring instruments, it would circumvent reporting false goal achievement. This competitive gaming scenario could also be done at the team level. Health and Fitness product sponsors could use the invention to hold promotional fitness contests giving away prizes to those whom safely achieve optimized fitness goals.

In FIG. 4 steps performed by a software application that matches a user profile to entries of database 39a are illustrated. In step 41, a user profile for a particular user is received from client computer11. It should be noted that after the user initially responses to the questionnaires discussed above, data collected from one or more sensors 29a-h are received from client computer 11. Once the partial user profile containing the data collected from one or more sensors 29a-h, is received, a full profile is generated using the profiles already stored in database 39b. Alternatively, the partial user profile is used in the matching step.

In step 43, the profile is converted into a vector. In other words, each attribute of the profile becomes a component of the vector, thereby representing the profile as one vector. In step 45, vectors for every entry in health education material database 39a are formed. It should be noted that this step can be performed off-line before step 41.

In step 47, every vector formed by the entries in health education database is compared with the vector formed by the user profile. One such comparison is depicted numerically in Table 10 and graphically in FIG. 5. The difference between the user vector and an exemplary entry represents the correlation between them. In particular, a smaller difference represents better matching than a large difference.

In step 49, using the results of vector comparisons, the best matching entries are identified and selected. Subsequently, the selected entries are downloaded to client computer 11 (step 51). For instance, if the selected entry is a written article, a Web page containing the article is downloaded to client computer 11 to be displayed on monitor 23. If the selected entry is an audio file, the audio file is downloaded to client computer 11 to be played on speakers 21.

In an alterative embodiment, instead of performing vector comparisons, absolute values of the vectors are compared with each other in order to reduce computation complexities.

The attributes of the profiles may be highly correlated because the attributes may contain considerable redundant information. For instance, a user profile (or a profile of a health education material) having 100 attributes may only contain a smaller number of uncorrelated attributes. Therefore, a software application configured to reduce the number of attributes in profiles is desired. Steps performed by such a software application are illustrated in FIG. 6. The software application allows health education database 39a to be populated as discussed above. Once, health education database 39a is populated, an eigenvector analysis is performed on entries of health education material database 39a (step 53). Each eigenvector represents linearly independent (*i.e.*, no correlation among eigenvectors) component. In step 55, an eigenvalue of each eigenvalue is calculated. An eigenvalue is a measure of the variance contributed by its eigenvector as compared to all of the others.

$$Var_{pc(n)} = \frac{Eigenvalue\ (n)}{Sum\ of\ all\ Eigenvalues}$$

Eigenvectors with high variance are selected as principal components (step 57). The entries in databases 39a,b are then transformed using the principal components. The user profile is also transformed using the same principal components. It should be noted that similar steps of eigenvector analysis may be performed on entries of user profile database 39b. It should be noted that attributes necessary to form the principal components contain highly relevant data in performing the matching steps. Therefore, in an alternative embodiment, data/information relating only to those attributes are collected and utilized.

In the preferred embodiment, the transformed entries of database 39a are further processed to be clustered into a number of prototypes (*i.e.*, classes), step 61. More specifically, the transformed entries may form a number of clusters. Each of these clusters may represent common characteristics of a group of users and/or a group of health educated materials. Cluster analysis is a class of techniques in which like members are grouped together in classes to form composite prototypes. As database 39a grows in size, clustering is preferred both to reduce the time of the matching process and to improve the reliability of the health regimens prescribed. The above discussed steps are preferably performed off-line.

In operation, a new user profile is received from client computer 11 (step 41). The user profile is transformed using the principal components (*e.g.*, multiplied with the selected eigenvectors; step 63). In step 65, the transformed user profile is matched against the prototypes. The matching is preferably accomplished using a well-known form of pattern recognition analysis known as discussed in K-Nearest Neighbor as referenced in Dasrathy, B.V., Nearest Neighbor (NN) Norms: NN Pattern Classification Techniques, IEEE, 1991 and Tou, J.T. and Gonzalez, R.C., Pattern Recognition Principles, Addison-Wesley, 1981. K-Nearest Neighbor is a classification method in which the classification of a pattern depends on the class assignment of its K nearest neighbors. Nearness is preferably defined in terms of Euclidean distance, but other measures such as cross-correlation (shape of profile function) or Mahalanobis distance (eliminates correlation effects) may also be used. A user profile may not fit exactly with any of the prototypes. Often, a user profile is located between prototypes in the sense that it could have been classified as belonging to one prototype cluster as well as to another. To allow for this "multiple matching" requirement, a modified version of K-Nearest Neighbor pattern recognition called Fuzzy K-Nearest Neighbor (or Fuzzy KNN for short) is provided. The fuzzy classification preferably takes the form of drawing from multiple entries. A discussion on Fuzzy K-Nearest neighbor is provided in Keller, J.M. et. al., "A Fuzzy K-Nearest Neighbor Algorithm", IEEE Trans. Systems, Man and Cybernetics, SMC-15, 4, 580-585, 1985.

In an alternative embodiment, the vector matching scheme discussed above may be utilized here to compare the principal component transformed user profile with the principal component transformed database 39a entries. Whether the transformed profile is

matched against the prototypes or against the transformed entries, best matching entries in database 39a are identified and forwarded to client computer 11 (steps 67 and 68).

The present invention also observes whether the user makes progress in meeting his/her goals and/or whether the user's health is being improved over time when receiving health education materials from Web server 15. An exemplary goal is achieving a predetermined body fat/muscle composition. Based on its observations, Web server 15 adaptively updates which health education materials are to be forwarded to the user. Steps performed by a software application for adaptive updates are illustrated in FIG. 7. In step 41, an initial user profile is received from client computer 11. In step 73, any one of the matching methods discussed above is utilized to identify best matching health education materials. In steps 75 and 77, the identified entries are forwarded to client computer 11. In step 79, a second user profile is received from client computer 11 after providing sufficient time for the user to read, understand and follow information contained in the health education materials forwarded to him/her. The second user profile may include data collected from one or more sensors 29a-h and/or more questions asked to the user (*e.g.*, subjective physiological measures and/ or psychological objectives). The second user profile is preferably received from time to time.

In step 81, the initial user profile is compared with periodic user profiles and goals of the user to generate an ongoing error signal. If the goal is being met (*e.g.*, the error signal is below a predetermined value), then no action is taken. However, if the goal is not met, then the error signal is used to modify (adapt) the control strategy by changes in the existing health regimen or introduction of new activities (diet changes, physical exercise activity) from related health education materials (step 83).

The adaptive control strategy is a combination of logical and mathematical structures. Within an existing health education program (*e.g.*, forwarding a series of related health education materials), a mathematical approach is possible through modification of the parameters of the health program. Introduction of new health program structures may require a logical (*i.e.*, a decision tree) format. The logic approach will be similar to that used in conventional expert systems. The approach to building such a logical structure, however, will differ from most expert systems in that a database (*e.g.*, database 39a) rather than expert opinion will be the knowledge foundation of the model. Techniques such as classification and regression trees are preferably used to build the logic structure. Examples

of adaptive control strategy are discussed in Seborg, D.E. et. al., "Adaptive Control Strategies for Process Control: A Survey", AlChE Journal, 32(6):881-913, 1986 and Orfanidis, S., Optimum Signal Processing, MacMillan, 1998.

In another aspect of the present invention, sensors 29a-h are calibrated and/or checked for errors adaptively by utilizing data collected therefrom. In conventional systems, adaptive calibration is not provided. For instance, a conventional sensor is initially calibrated using a control group (as in any medical study). However, once the conventional sensor is in operation, it cannot be adjusted when its user does not fit the model presented by the control group or when new information becomes available, thereby making the original calibration outdated.

The above-described shortcomings are overcome in the present invention because it collects data from a variety of sensors (*e.g.*, sensors 29a-h) and stores them in a database (*i.e.*, database 39b). These components allow an adaptive calibration software application to be used in the present invention. Correction of inaccuracies due to the control group not fitting the user is eliminated or reduced by utilizing statistics of historical data collected and stored in database 39b. Moreover, detection and correction of erroneous data collected from one or more sensors are possible because the erroneous data would be out of bounds (an indication of anomaly) when compared with the rest of sensors.

More specifically, the adaptive software application is configured to adaptively calibrate data collected from sensors 29a-h. For instance, consider a user who is using the present invention and begins with a lean body mass of "x" percent. The caloric burn rate of this user is "c" calories per day, based upon the control group's model that fits the profile for that user. Over time, that user may experience an increase in lean body mass to "y" percent. In accordance with well-known physiological principles, the increased muscle mass should result in a higher caloric burn rate. In accordance with the present invention, the adaptive calibration software detects this new lean body mass value of "y" percent, and adjusts data collected from other sensors and calorie expenditure calculations accordingly, to reflect the new caloric burn rate. This information is then noted in database 39b and serves as a historical marker.

In the situation when a calibration is found to be invalid or outdated, the present invention adaptively updates, refines and or adjusts the calibration. As the user incorporates more sensors into his/her personal monitoring program, and as the sensors

themselves become more refined, the data itself becomes increasingly refined over time. Because the calibration itself resides on Web server 15, any data that is provided to database 39b will then utilize the current calibration that best fits the profile of the user. In this way the user is always using the most current calibration methods.

Although the preferred embodiments of the invention have been described in the foregoing description, it will be understood that the present invention is not limited to the specific embodiments described above. For example, a training person may be given a full access to information relating to a number of users of the present invention. The training person then may make recommendations directly to the user or modify educational regimen identified by the above described matching methods.

THE CLAIMS

What is claimed is:

1. A method of delivering health related information to a user, comprising:

receiving a first set of data from the user;

identifying first health related information based on the first set of data;

forwarding the first health related information to the user;

receiving a second set of data from the user after the first health related information has been forwarded to the user; and

determining whether progress has been made to achieve a goal based on the second set of data.

2. The method of claim 1 wherein the step of receiving the first set of data comprises:

receiving data relating to at least one of body fat/muscle composition, pulse rate and body movements of the user.

3. The method of claim 1 wherein the step of receiving the first set of data from the user comprises:

querying the user with questions relating to at least one of exercise preferences, social/learning tendencies and behavioral tendencies of the user; and

receiving responses to the questions from the user.

4. The method of claim 1 wherein the step of receiving the second set of data comprises:

receiving data relating to at least one of body fat/muscle composition, pulse rate and body movements of the user.

5. The method of claim 1 wherein the step of receiving the second set of data from the user comprises:

querying the user with questions relating to at least one of exercise preferences, social/learning tendencies and behavioral tendencies of the user; and

receiving responses to the questions from the user.

6. The method of claim 1 further comprising:

receiving the second set of data from the user from time to time.

7. The method of claim 1 further comprising:

assembling a plurality of education materials each of which contains health related information.

8. The method of claim 7 wherein the plurality of education materials are one of medical/health related journals, video clips and graphics.

9. The method of claim 7 further comprising:

assigning attribute values characterizing the plurality of education materials, wherein the first data set is a collection of attribute values characterizing a health status of the user.

10. The method of claim 9 wherein the step of identifying the first health related information comprises:

matching the attribute values of the first data set to the attribute values of the plurality of education materials.

11. The method of claim 10 wherein the step of matching comprises:

forming a vector based on the attribute values of the first set of data;

forming a plurality of vectors based on the attribute values of the plurality of education materials; and

comparing the vector of the first set of data with each of the plurality of vectors.

12. The method of claim 10 wherein the step of matching comprises:

performing eigenvector analysis on the attribute values of the plurality of education materials;

transforming the attribute values of the plurality of education materials with one or more eigenvectors; and

transforming the attribute values with the one or more eigenvectors.

13. The method of claim 12 wherein the step of matching further comprises:

performing a clustering analysis on the transformed attribute values of the plurality of education materials, to thereby identify one or more prototype education materials; and

performing a K nearest neighbor analysis to match the transformed first data set to the prototype education materials.

14. The method of claim 1 wherein in the goal is a predetermined level of body fat/muscle composition ratio.

15. The method of claim 14 further comprising:

selecting a new set of education materials to be forwarded to the user based on whether or not progress has been made to achieve the goal.

16. A method of delivering health related information to a user, comprising:

receiving a first set of data from the user, wherein the first data set is a collection of attribute values characterizing a health status of the user;

assembling a plurality of education materials each of which contains health related information;

assigning attribute values characterizing the plurality of education materials; and

matching the attribute values of the first data set to the attribute values of the plurality of education materials.

17. The method of claim 16 wherein the step of receiving the first set of data comprises:

receiving data relating to at least one of body fat/muscle composition, pulse rate and body movements of the user.

18. The method of claim 16 wherein the step of receiving the first set of data from the user comprises:

querying the user with questions relating to at least one of exercise preferences, social/learning tendencies and behavioral tendencies of the user; and

receiving responses to the questions from the user.

19. The method of claim 16 further comprising:

identifying first health related information based on the matching step; and

forwarding the first health related information to the user.

20. The method of claim 19 wherein the plurality of education materials are one of medical/health related journals, video clips and graphics.

21. The method of claim 16 wherein the step of matching comprises:

forming a vector based on the attribute values of the first set of data;

forming a plurality of vectors based on the attribute values of the plurality of education materials; and

comparing the vector of the first set of data with each of the plurality of vectors.

22. The method of claim 16 wherein the step of matching comprises:

performing eigenvector analysis on the attribute values of the plurality of education materials;

transforming the attribute values of the plurality of education materials with one or more eigenvectors; and

transforming the attribute values with the one or more eigenvectors.

23. The method of claim 22 wherein the step of matching further comprises:

performing a clustering analysis on the transformed attribute values of the plurality of education materials, to thereby identify one or more prototype education materials; and

performing a K nearest neighbor analysis to match the transformed first data set to the prototype education materials.

24. A method of adjusting calibrations for a plurality of sensors configured to measure a health status of a user, comprising:

receiving data from each of the plurality of sensors;

converting the received data using calibrations for each respective sensor;

comparing the converted data of a first sensor, among the plurality of sensors, with the converted data of other sensors, among the plurality of sensors; and

adjusting the calibration of the first sensor when converted data therefrom exhibit anomaly when compared with the converted data from other sensors.

25. The method of claim 24 further comprising:

adjusting calibration of a second sensor, among the plurality of sensors, when a third sensor, among the plurality of sensors, indicates a change in the health status of the user.

26. The method of claim 25 further comprising:

receiving body fat/muscle composition data from the second sensor;

receiving calorie expenditure data from the third sensor; and

adjusting the calibration of the third sensor when the second sensor indicates a change in the measured body fat/muscle composition.

27. A software program implemented in a first computer system for delivering health related information to a second computer, the software program configuring the first computer to:

receive a first set of data from the second computer;

identify first health related information based on the first set of data;

forward the first health related information to the second computer;

receive a second set of data from the second computer after the first health related information has been forwarded to the second computer; and

determine whether progress has been made to achieve a goal based on the second set of data.

28. The software of claim 27 further configuring the first computer to:

receive data relating to at least one of body fat/muscle composition, pulse rate and body movements of a user at the second computer as the first set of data.

29. The software of claim 27 further configuring the first computer to:

query a user at the second computer with questions relating to at least one of exercise preferences, social/learning tendencies and behavioral tendencies of the user; and

receive responses to the questions from the user as the first set of data.

30. The software of claim 27 further configuring the first computer to:

receive data relating to at least one of body fat/muscle composition, pulse rate and body movements of a user at the second computer as the second set of data.

31. The software of claim 27 further configuring the first computer to:

query a user at the second computer with questions relating to at least one of exercise preferences, social/learning tendencies and behavioral tendencies of the user; and

receive responses to the questions from the user as the second set of data.

32. The software of claim 27 further configuring the first computer to:

receive the second set of data from a user at the second computer from time to time.

33. The software of claim 27 further configuring the first computer to:

assemble a plurality of education materials each of which contains health related information.

34. The software of claim 33 wherein the plurality of education materials are one of medical/health related journals, video clips and graphics.

35. The software of claim 33 further configuring the first computer to:

assign attribute values characterizing the plurality of education materials, wherein the first data set is a collection of attribute values characterizing a health status of a user at the second computer.

36. The software of claim 35 further configuring the first computer to:

match the attribute values of the first data set to the attribute values of the plurality of education materials.

37. The software of claim 36 further configuring the first computer to:

form a vector based on the attribute values of the first set of data;

form a plurality of vectors based on the attribute values of the plurality of education materials; and

compare the vector of the first set of data with each of the plurality of vectors.

38. The software of claim 36 further configuring the first computer to:

perform eigenvector analysis on the attribute values of the plurality of education materials;

transform the attribute values of the plurality of education materials with one or more eigenvectors; and

transform the attribute values with the one or more eigenvectors.

39. The software of claim 36 further configuring the first computer to:

perform a clustering analysis on the transformed attribute values of the plurality of education materials, to thereby identify one or more prototype education materials; and

perform a K nearest neighbor analysis to match the transformed first data set to the prototype education materials.

40. The software of claim 27 wherein in the goal is a predetermined level of body fat/muscle composition ratio.

41. The software of claim 40 further configuring the first computer to:

select a new set of education materials to be forwarded to the user based on whether or not the progress has been made to achieve the goal.

42. A software program implemented in a first computer system for delivering health related information to a second computer, the software program configuring the first computer to:

receive a first set of data from a user at the second computer, wherein the first data set is a collection of attribute values characterizing a health status of the user;

assemble a plurality of education materials each of which contains health related information;

assign attribute values characterizing the plurality of education materials; and

match the attribute values of the first data set to the attribute values of the plurality of education materials.

43. The software of claim 42 further configuring the first computer to:

receive data relating to at least one of body fat/muscle composition, pulse rate and body movements of the user as the first set of data.

44. The software of claim 42 further configuring the first computer to:

query the user with questions relating to at least one of exercise preferences, social learning tendencies and behavioral tendencies of the user; and

receive responses to the questions from the user as the first set of data.

45. The software of claim 42 further configuring the first computer to:

identify first health related information based on the match; and

forward the first health related information to the user.

46. The software of claim 45 wherein the plurality of education materials are one of medical/health related journals, video clips and graphics.

47. The software of claim 42 further configuring the first computer to:

form a vector based on the attribute values of the first set of data;

form a plurality of vectors based on the attribute values of the plurality of education materials; and

compare the vector of the first set of data with each of the plurality of vectors.

48. The software of claim 42 further configuring the first computer to:

perform eigenvector analysis on the attribute values of the plurality of education materials;

transform the attribute values of the plurality of education materials with one or more of eigenvectors; and

transform the attribute values with the one or more eigenvectors.

49. The software of claim 48 further configuring the first computer to:

perform a clustering analysis on the transformed attribute values of the plurality of education materials, to thereby identify one or more prototype education materials; and

perform a K nearest neighbor analysis to match the transformed first data set to the prototype education materials.

50. A software program implemented in a computer system for adjusting calibrations for a plurality of sensors, the software program configuring the computer to:

receive data from each of the plurality of sensors;

convert the received data using calibrations for each respective sensor;

compare the converted data of a first sensor, among the plurality of sensors, with the converted data of other sensors, among the plurality of sensors; and

adjust the calibration of the first sensor when converted data therefrom exhibit anomaly when compared with the converted data from other sensors.

51. The software of claim 50 further configuring the computer to:

adjust calibration of a second sensor, among the plurality of sensors, when a third sensor, among the plurality of sensors, indicates a change in the health status of the user.

52. The software of claim 51 further configuring the computer to:

receive body fat/muscle composition data from the second sensor;

receive calorie expenditure data from the third sensor; and

adjust the calibration of the third sensor when the second sensor indicates a change in the measured body fat/muscle composition.

53. A computer system for delivering health related information to a client computer, comprising:

a server computer configured to:

receive a first set of data from the client computer;

identify first health related information based on the first set of data;

forward the first health related information to the client computer;

receive a second set of data from the client computer after the first health related information has been forwarded to the client computer; and

determine whether progress has been made to achieve a goal based on the second set of data.

54. The system of claim 53 wherein the server computer is further configured to:

receive data relating to at least one of body fat/muscle composition, pulse rate and body movements of a user at the client computer as the first set of data.

55. The system of claim 53 wherein the server computer is further configured to:

query a user at the client computer with questions relating to at least one of exercise preferences, social/learning tendencies and behavioral tendencies of the user; and

receive responses to the questions from the user as the first set of data.

56. The system of claim 53 wherein the server computer is further configured to:

receive data relating to at least one of body fat/muscle composition, pulse rate and body movements of a user at the client computer as the second set of data.

57. The system of claim 53 wherein the server computer is further configured to:

query a user at the client computer with questions relating to at least one of exercise preferences, social/learning tendencies and behavioral tendencies of the user; and

receive responses to the questions from the user as the second set of data.

58. The system of claim 53 wherein the server computer is further configured to:

receive the second set of data from a user at the client computer from time to time.

59. The system of claim 53 wherein the server computer is further configured to:

assemble a plurality of education materials each of which contains health related information.

60. The system of claim 59 wherein the plurality of education materials are one of medical/health related journals, video clips and graphics.

61. The system of claim 59 wherein the server computer is further configured to:

assign attribute values characterizing the plurality of education materials, wherein the first data set is a collection of attribute values characterizing a health status of a user at the client computer.

62. The system of claim 61 wherein the server computer is further configured to:

match the attribute values of the first data set to the attribute values of the plurality of education materials.

63. The system of claim 62 wherein the server computer is further configured to:

form a vector based on the attribute values of the first set of data;

form a plurality of vectors based on the attribute values of the plurality of education materials; and

compare the vector of the first set of data with each of the plurality of vectors.

64. The system of claim 62 wherein the server computer is further configured to:

perform eigenvector analysis on the attribute values of the plurality of education materials;

transform the attribute values of the plurality of education materials with one or more eigenvectors; and

transform the attribute values with the one or more eigenvectors.

65. The system of claim 62 wherein the server computer is further configured to:

perform a clustering analysis on the transformed attribute values of the plurality of education materials, to thereby identify one or more prototype education materials; and

perform a K nearest neighbor analysis to match the transformed first data set to the prototype education materials.

66. The system of claim 53 wherein in the goal is a predetermined level of body fat/muscle composition ratio.

67. The system of claim 66 wherein the server computer is further configured to:

select a new set of education materials to be forwarded to the user based on whether or not the progress has been made to achieve the goal.

68. A computer system for delivering health related information to a client computer, comprising:

a server computer configured to:

receive a first set of data from a user at the client computer, wherein the first data set is a collection of attribute values characterizing a health status of the user;

assemble a plurality of education materials each of which contains health related information;

assign attribute values characterizing the plurality of education materials; and

match the attribute values of the first data set to the attribute values of the plurality of education materials.

69. The system of claim 68 wherein the server computer is further configured to:

receive data relating to at least one of body fat/muscle composition, pulse rate and body movements of the user as the first set of data.

70. The system of claim 68 wherein the server computer is further configured to:

query the user with questions relating to at least one of exercise preferences, social/learning tendencies and behavioral tendencies of the user; and

receive responses to the questions from the user as the first set of data.

71. The system of claim 68 wherein the server computer is further configured to:

identify first health related information based on the match; and

forward the first health related information to the user.

72. The system of claim 71 wherein the plurality of education materials are one of medical/health related journals, video clips and graphics.

73. The system of claim 68 wherein the server computer is further configured to:

form a vector based on the attribute values of the first set of data;

form a plurality of vectors based on the attribute values of the plurality of education materials; and

compare the vector of the first set of data with each of the plurality of vectors.

74. The system of claim 68 wherein the server computer is further configured to:

perform eigenvector analysis on the attribute values of the plurality of education materials;

transform the attribute values of the plurality of education materials with one or more of eigenvectors; and

transform the attribute values with the one or more eigenvectors.

75. The system of claim 74 wherein the server computer is further configured to:

perform a clustering analysis on the transformed attribute values of the plurality of education materials, to thereby identify one or more prototype education materials; and

perform a K nearest neighbor analysis to match the transformed first data set to the prototype education materials.

76. A system for adjusting calibrations for a plurality of sensors, comprising:

a computer configured to:

receive data from each of the plurality of sensors;

convert the received data using calibrations for each respective sensor;

compare the converted data of a first sensor, among the plurality of sensors, with the converted data of other sensors, among the plurality of sensors; and

adjust the calibration of the first sensor when converted data therefrom exhibit anomaly when compared with the converted data from other sensors.

77. The system of claim 76 wherein the computer is further configured to:

adjust calibration of a second sensor, among the plurality of sensors, when a third sensor, among the plurality of sensors, indicates a change in the health status of the user.

78. The system of claim 77 wherein the computer is further configured to:

receive body fat/muscle composition data from the second sensor;

receive calorie expenditure data from the third sensor; and

adjust the calibration of the third sensor when the second sensor indicates a change in the measured body fat/muscle composition.

79. The system of claim 76 wherein the computer is further configured to:

process the received data, to thereby minimize hardware requirement of the pluralilty of sensors.

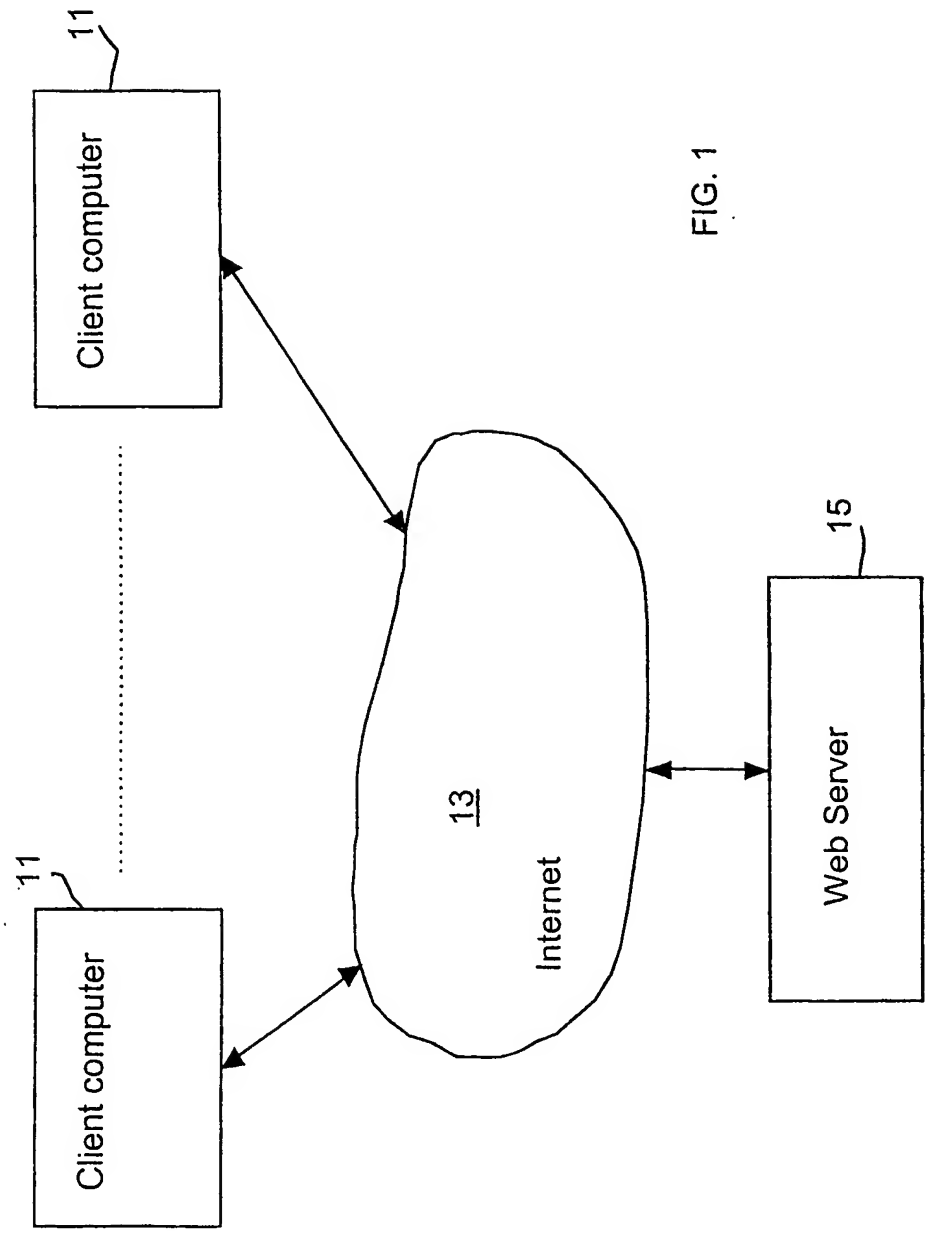


FIG. 1

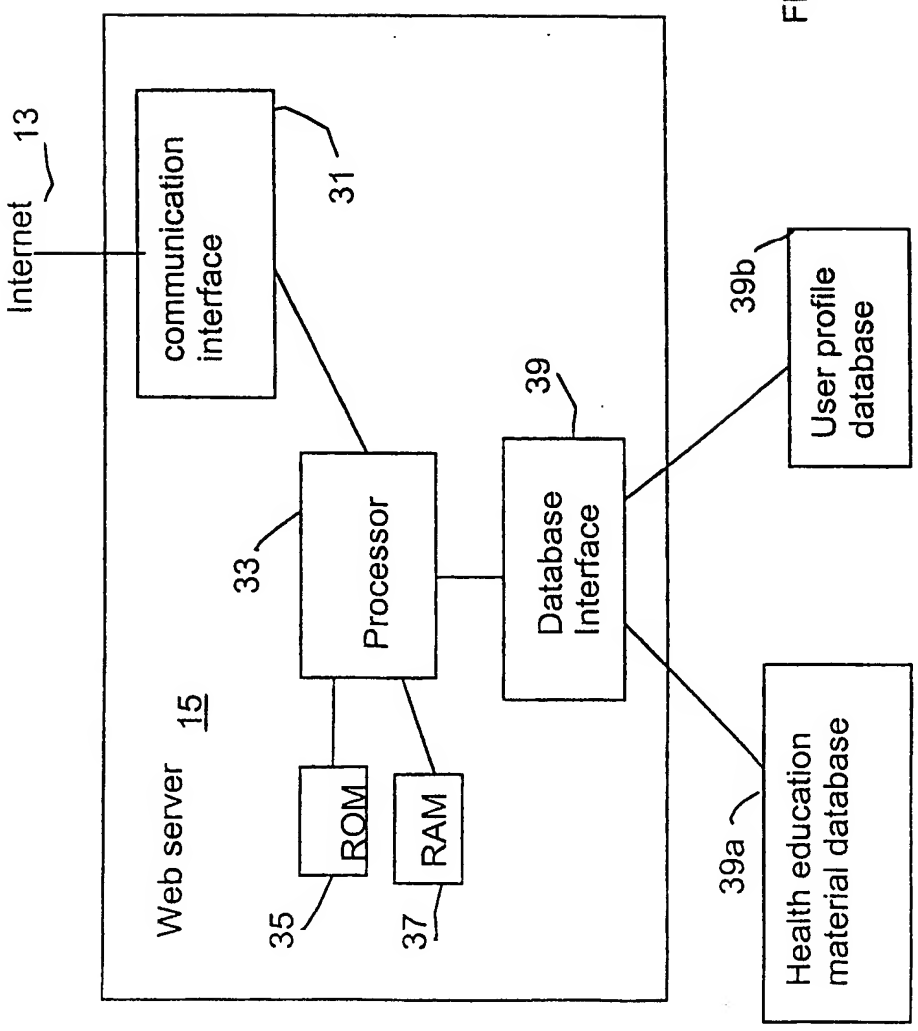


FIG. 3

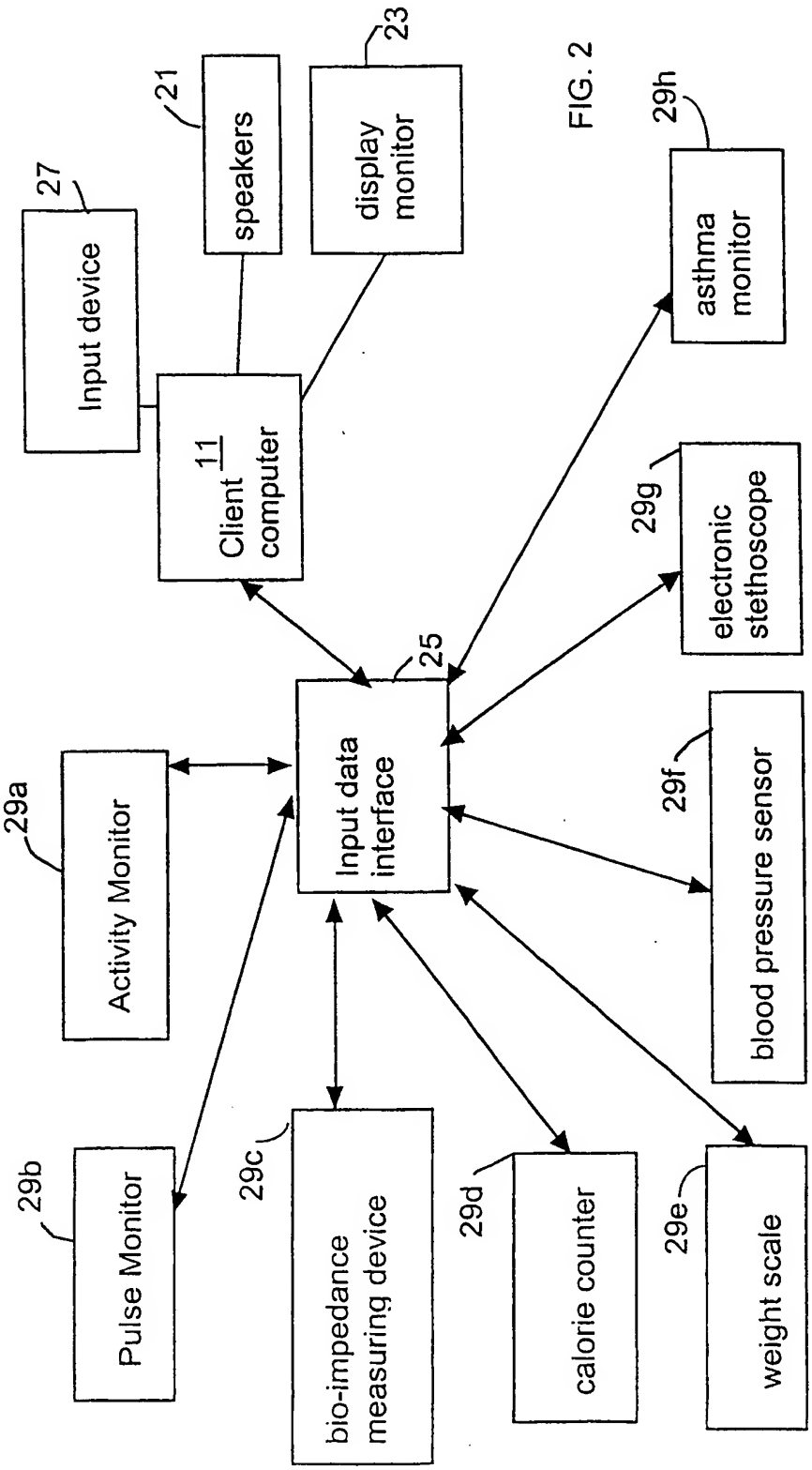


FIG. 2

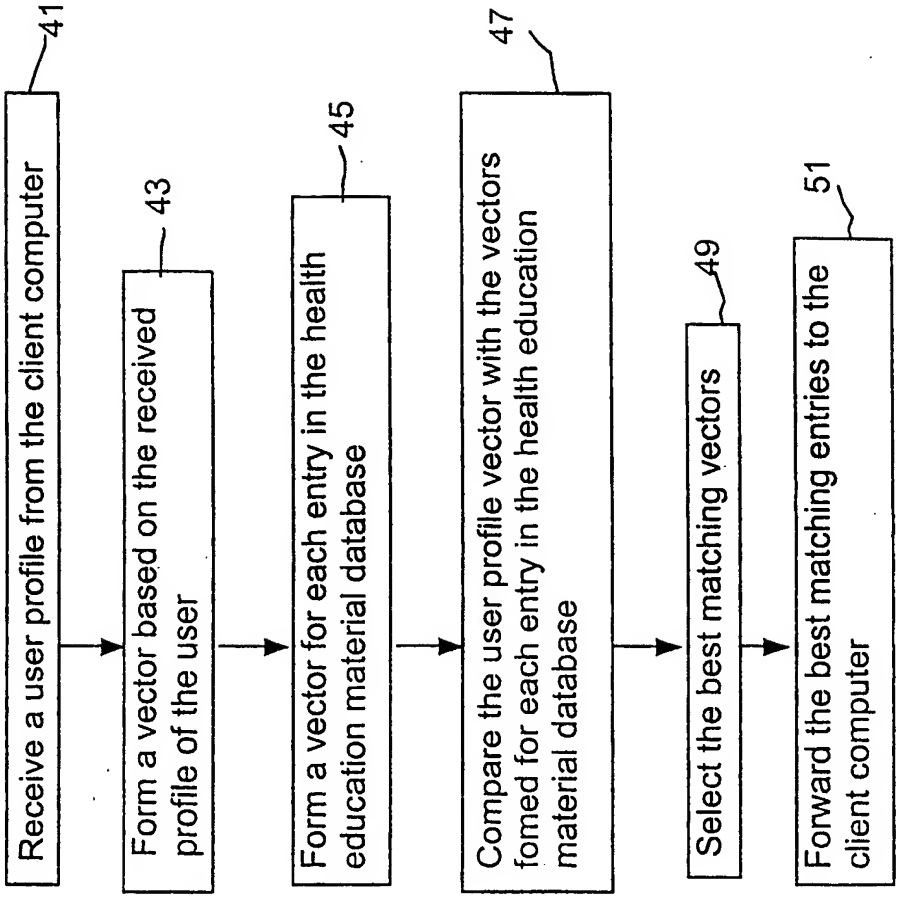


FIG. 4

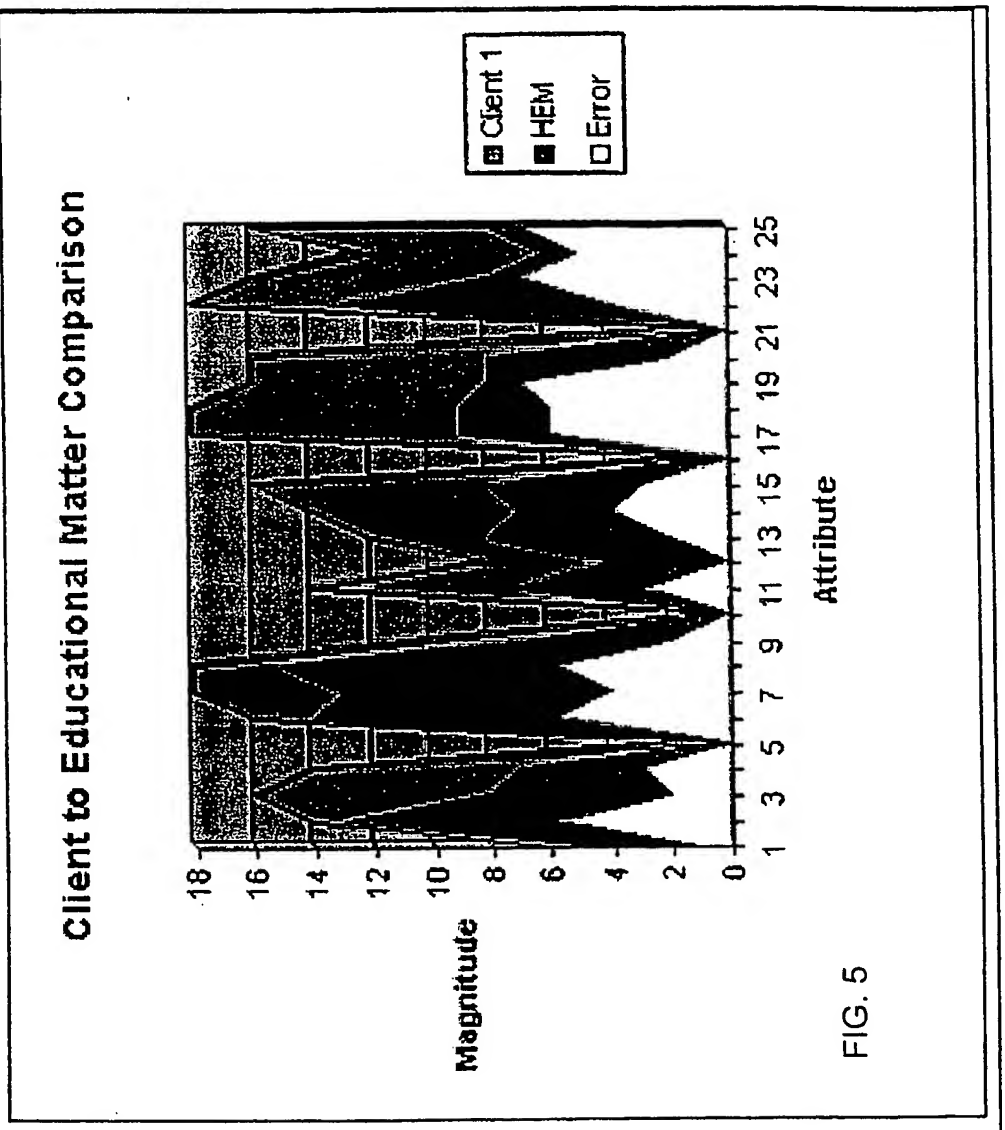


FIG. 5

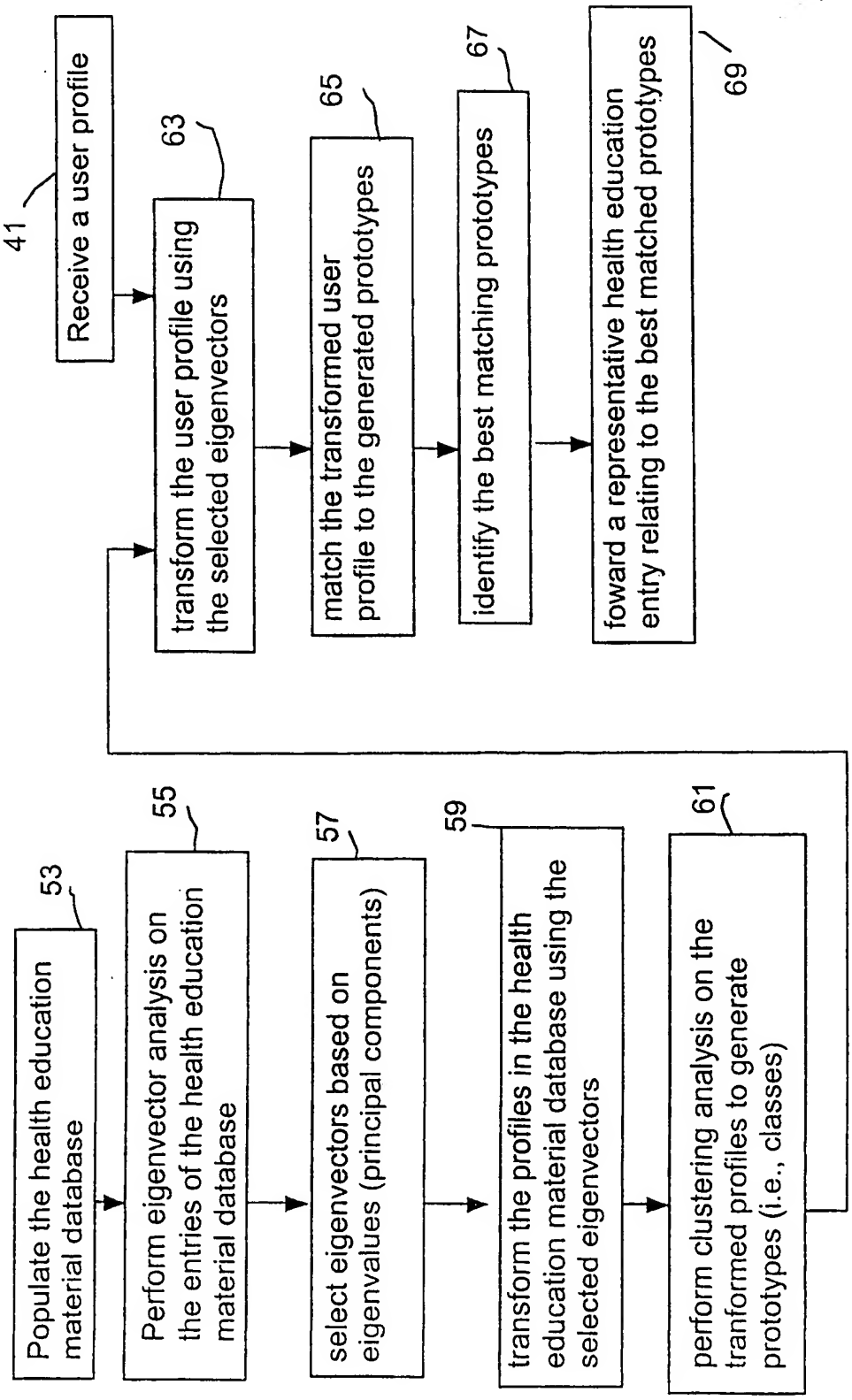


FIG. 6

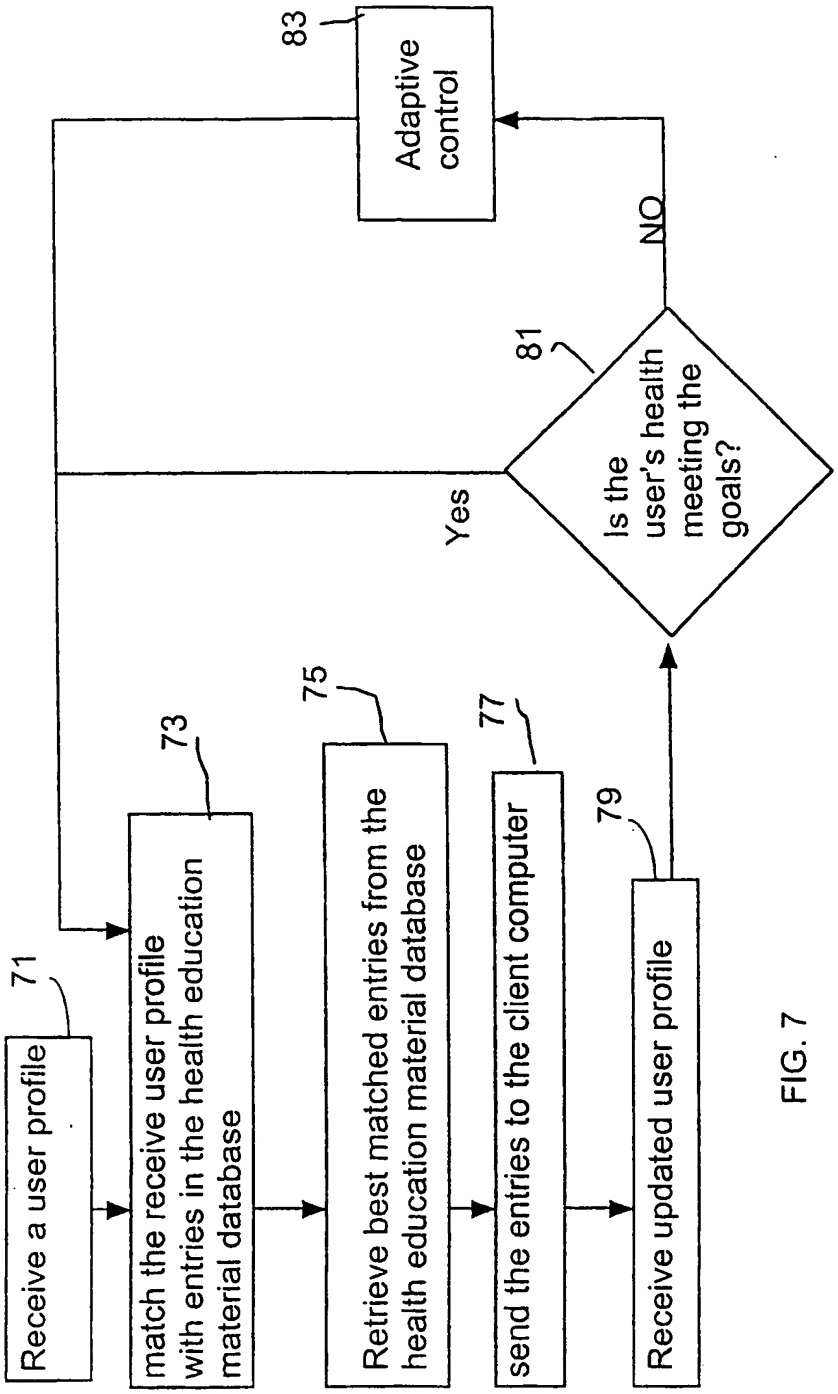


FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/05790

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :G06F 17/30

US CL : 707/5, 6; 705/ 2, 3, 26, 27, 28; 272/129; 128/670, 696

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 707/5, 6; 705/ 2, 3, 26, 27, 28; 272/129; 128/670, 696

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WEST

Search terms: health related information, education, monitoring goal, progress, ranking, vector,

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4,828,257 A (DYER et al) 09 May 1989, col. 1, lines 31-50, col. 3, lines 57-67, col. 4, lines 1-35 and lines 48-52, col. 10, lines 32-63, col. 11, lines 15-32, col. 15, lines 28-49, col. 16, lines 4-7, col. 18, lines 46-68, col. 20, lines 15-35 and lines 50-68, col. 21, lines 1-68, col. 22, lines 1-42, col. 23, lines 6-11 and lines 36-68, col. 24, lines 1-2 and lines 65-68, col. 25, lines 1-23 and lines 32-67, col. 26, lines 1-2 and lines 45-50, col. 28, lines 1-22, col. 31, lines 7-60, col. 37, lines 65-68, and col. 38, lines 1-24.	1-79

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

*	Special categories of cited documents	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 02 JUNE 2000	Date of mailing of the international search report 03 JUL 2000
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer KIM VU Telephone No. (703) 305-4393

Form PCT/ISA/210 (second sheet) (July 1998) *

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/05790

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,490,516 A (HUTSON) 13 February 1996, col. 1, lines 20-41 and lines 65-67, col. 2, lines 1-6 and lines 50-67, col. 3, lines 1-15, col. 4, lines 21-44, col. 6, lines 66-67, col. 7, lines 1-12, col. 8, lines 14-20 and 66-67, col. 9, lines 1-67, col. 10, lines 1-37, col. 13, lines 6-15 and lines 41-67, col. 16, lines 41-58, col. 17, lines 26-67, col. 18, lines 60-67, and col. 19, lines 1-9.	1-79
Y	US 5,435,315 A (MCPHEE et al) 25 July 1995, col. 1, lines 20-68, col. 2, lines 1-33 and lines 56-68, col. 3, lines 1-65, col. 5, lines 51-68, col. 6, lines 1-44, col. 8, lines 31-45, col. 9, lines 16-27 and lines 35-61, col. 10, lines 1-44 and lines 63-68, and col. 12, lines 19-30.	1-79

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

CORRECTED VERSION

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
8 September 2000 (08.09.2000)

PCT

(10) International Publication Number
WO 00/52604 A1

(51) International Patent Classification[7]: G06F 17/30

(21) International Application Number: PCT/US00/05790

(22) International Filing Date: 6 March 2000 (06.03.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/122,932 5 March 1999 (05.03.1999) US
09/518,781 3 March 2000 (03.03.2000) US

(71) Applicant: STAYHEALTY. COM [US/US]; 690 1/2 E. Bridge Street, Elkader, IA 52043 (US).

(72) Inventors: COLLINS, John, R.; 225 Elcilo Lane, Bradbury, CA 91010 (US). GREEN, Ronald, L.; 906 North Main Street, Elkader, IA 52043 (US). DAVIS, Leslie, G.; 301 Chestnut Street, Elkader, IA 52043 (US). KAVARS, Christopher, L.; 160 Sandy Lane, Clermont, IA 52135 (US). CARNES, Bradley, J.; 125 1/2 South Main Street, Elkader, IA 52043 (US). PETERSEN, Brian, W.; 2822 North Frederick Avenue, Milwaukee, WI 53211 (US). SCHLAGER, Kenneth, J.; 12825 Elmwood Road, Elm Grove, WI 53122 (US).

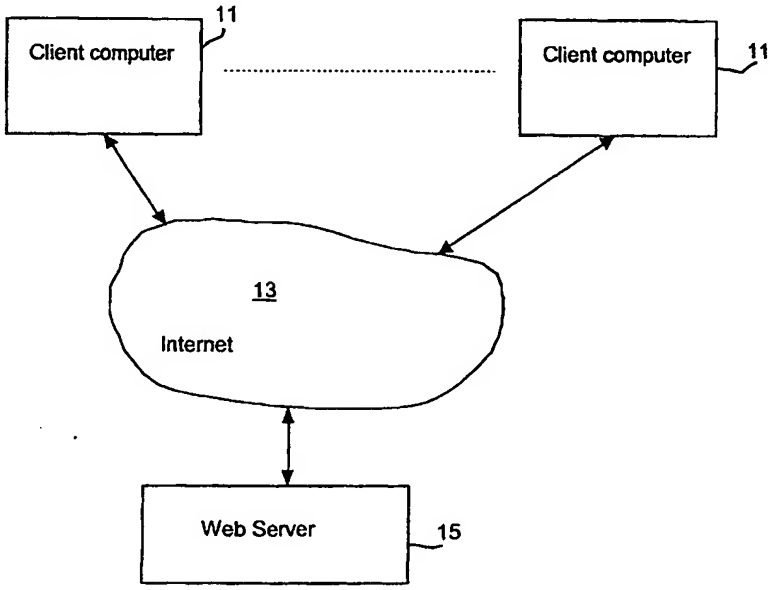
(74) Agents: MORRIS, Francis, E. et al.; Pennie & Edmonds LLP, 1155 Avenue of the Americas, New York, NY 10036 (US).

(81) Designated States *(national)*: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent

[Continued on next page]

(54) Title: SYSTEM AND METHOD FOR ON-LINE HEALTH MONITORING AND EDUCATION



(57) Abstract: A method of delivering health related information to a user (13). The method includes the steps of receiving a first set of data from the user (11), identifying first health related information based on the first set of data and forwarding (15) the first health related information to the user. The method further includes the steps of receiving a second set of data from the user (11) after the first health related information has been forwarded to the user and determining whether progress has been made to achieve a goal based on the second set of a data. A corresponding software application and a system (13) are also discussed.

WO 00/52604 A1

(AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *With international search report.*

(48) Date of publication of this corrected version:
17 May 2001

(15) Information about Correction:
see PCT Gazette No. 20/2001 of 17 May 2001, Section II

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.